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HEWLETT-PACKARD COMPANY
Intellectual Property Administration
P.O. Box 272400
Fort Collins, CO 80527-2400

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte JEFFREY ALLEN NEILSEN,
STEVEN T. CASTLE, and
DAVID C. COLLINS

Appeal 2008-3876
Application 10/603,896
Technology Center 1700

Decided: November 12, 2008

Before CHUNG K. PAK, PETER F. KRATZ, and CATHERINE Q. TIMM, *Administrative Patent Judges*.

TIMM, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants appeal under 35 U.S.C. § 134(a) from the Examiner's decision rejecting claims 1-19. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

I. STATEMENT OF THE CASE

The invention relates to a method for improving color quality in an object created by a solid freeform fabrication system by causing a reaction that keeps a colorant in an ejected material near a surface of the object. (Spec. 3, ll. 3-6). Claim 1 is illustrative of the subject matter on appeal:

1. A method of improving color quality in an object created by a solid freeform fabrication system that uses a fluid ejection process to build successive layers of the object being fabricated, the method comprising:

ejecting a first material to form a layer of a three-dimensional object, the first material containing a colorant; and

causing a reaction that keeps the colorant near a surface of the object.

Appellants request review of the sole rejection maintained by the Examiner, namely, the rejection of claims 1-19 under 35 U.S.C. § 103(a) over U.S. Patent No. 6,401,002 B1, issued on June 4, 2002, to Jang et al. (hereinafter "Jang"), in view of either U.S. Patent No. 5,181,045, issued on January 19, 1993, to Shields et al. (hereinafter "Shields I") or U.S. Patent No. 5,428,383, issued June 27, 1995, to Shields et al. (hereinafter "Shields II").[1]

Appellants do not present separate arguments as to any particular claim but rather address the claims as a group. Accordingly, we decide the

[1] Appellants additionally requested review of a rejection under 35 U.S.C. §112, second paragraph. (App. Br. 4-5). However, the Examiner withdrew this rejection in the Examiner's Answer. (Ans. 2).

appeal on the basis of independent claim 1. *See* 37 C.F.R. § 41.37(c)(1)(vii) ("When multiple claims subject to the same ground of rejection are argued as a group by appellant, the Board may select a single claim from the group of claims that are argued together to decide the appeal with respect to the group of claims as to the ground of rejection on the basis of the selected claim alone.").

II. DISCUSSION

Appellants argue that the reactions taught by Shields I and Shields II are not the same as the claimed reaction that keeps a colorant near a surface of a three-dimensional object. (App. Br. 8-9 and 11). The Examiner responds that the reactions taught by Shields I and Shields II inherently keep a colorant near a surface of a three-dimensional object. (Ans. 7). Thus, the contentions of Appellants and the Examiner raise the following first issue: do Shield I and Shield II teach the claimed reaction which keeps a colorant near a surface of a three-dimensional object?

The Examiner's rejection states that one of ordinary skill in the art would have combined the teachings of Jang and Shields I or Shields II "in order to manufacture an object having a desired color and/or desired color pattern." (Ans. 5). Yet, Appellants also argue that the Examiner's rejection lacks motivation or suggestion "to modify and combine the references [i.e., Jang and either Shields I or Shields II] as suggested in the instant Office Action." (App. Br. 9 and 12). Thus, the contentions of Appellants and the Examiner raise the following second issue: do the references provide a reasonable rationale for combining the teachings of Jang and Shields I or Shields II?

Appellants also argue that one of ordinary skill in the art would not have a reasonable expectation of success if the references were combined as suggested by the Examiner because "2-D printing techniques (as taught by Shields I, for example) are not necessarily useful or applicable to 3-D rapid prototyping processes." (App. Br. 9). The Examiner responds that one of ordinary skill in the art would have had a reasonable expectation of success because each of the references is "directed to making objects having color." Thus, the contentions of Appellants and the Examiner raise the following third issue: would one of ordinary skill in the art have expected the reactions taught by Shields I and Shields II to be successful in a three-dimensional rapid prototype process as taught by Jang?

We answer these questions in the affirmative.

The evidence of record supports the following Findings of Fact (FF):

1. Shields I teaches causing a reaction between a first ink having a carboxylated dye and a second ink having a relatively low pH. (Shields I, col. 2, ll. 26-52).

2. Shields I teaches that at a border between the two inks, a reaction occurs, such that the carboxylated dye of the first ink becomes insoluble and precipitates. (Shields I, col. 2, ll. 32-38).

3. According to Shields I, "[b]y forcing the dye to become insoluble on the page, migration of the dye is inhibited, thereby helping to reduce bleed between different colors." (Shields I, col. 2, ll. 5-8).

4. Shields II teaches causing a reaction between a first ink having a carboxylated dye and a second ink having a multi-valent metal salt. (Shields II, col. 3, ll. 23-30 and 40-41).

5. Shields II teaches that, upon contact at a border between the two inks, a reaction occurs, such that the carboxylated dye of the first ink becomes insoluble and precipitates. (Shields II, col. 2, ll. 33-36).

6. According to Shields II, the "[p]recipitate formation prevents migration of the coloring agent from the first ink composition into the second ink composition." (Shields II, col. 3, ll. 36-40).

7. Shields I also teaches that it was well known in the ink printing art to utilize this same low pH /carboxylated dye reaction to achieve waterfastness of a single ink constituent, when a paper substrate, rather than a second ink, is a low pH material. (Shields I, col. 2, ll. 53 to col. 3, l. 6).

8. Appellants' Specification teaches that

> The colorant in the ejected material is caused to remain near the surface of each layer of the object by precipitating (or "crashing") the colorant out of the ejected material as the object is formed. Without subscribing to any particular theory, applicants believe that by forcing a colorant to become insoluble (and thereby precipitate out of the ejected material) as the object is formed, the migration of the colorant will be inhibited, thereby reducing penetration of the colorant into the object and improving the sharpness or crispness of borders between different adjacent colors. The "force" used to make the colorant crash or precipitate out of solution may be, for example, a pH reaction or a cationic-anionic reaction.

(Spec. 8, ll. 9-17).

9. Appellants' Specification teaches that the pH reaction includes the reaction of carboxylated dyes and a material having a low pH, where the carboxylated dye is a colorant in a binder which is ejected into a low pH

powder build material to form the solid object. (Spec. 8, ll. 19-26 and 9, ll. 20-29).

10. Appellants' Specification also teaches a general anionic-cationic reaction, which includes the reaction of a colorant (e.g., in a binder material) that is anionic with a powder build material that includes a cationic component. (Spec. 8, ll. 27-32 and 10, ll. 13-19).

11. Jang teaches that "[t]here are a broad array of liquid droplet deposition devices that can be incorporated in the presently invented apparatus. One type of deposition devices [sic] is a thermal ink jet print-head." (Jang, col. 11, ll. 20-23).

12. Jang also teaches "fabricating a three-dimensional object on a layer-by-layer basis" by "co-deposition of ejected liquid droplets and solid powder particles" in which "[l]iquid droplets may also contain desired color dyes for building a multi-color object." (Jang, col. 5, ll. 47-54).

13. Jang teaches that "[f]or making colored objects, preferably each composition also contains a color-making ingredient (referred to as a colorant or ink), which may be a dye, pigment, color concentrate (commonly used in coloring of plastics), or combinations thereof." (Jang, col. 8, ll. 35-39).

14. Jang teaches "a plurality of separate droplet deposition devices with each device being supplied with possibly different liquid compositions containing different colorants and being capable of ejecting the liquid compositions in the form of droplets on demand." (Jang, col. 7, ll. 30-35).

15. Shields I and Shields II are directed to thermal ink-jet printing techniques. (Shields I, col. 1, ll. 6-11; Shields II, col. 1, ll. 7-11).

16. Appellants' Specification discloses that "[b]ecause color can be primarily a surface property, the color projection of the object does not need to proceed very far into the interior of the object being fabricated." (Spec. 7, ll. 19-21).

17. Appellants' Specification discloses that "[t]he colorant in the ejected material is caused to remain near the surface of each layer of the object by precipitating (or 'crashing') the colorant out of the ejected material as the object is formed." (Spec. 8, ll. 9-11).

18. Appellants' Specification discloses that

> [c]olorant in the ejected material (either an ejected binder or an ejected build material) is caused to remain near the surface of the layer being fabricated, such that the color accuracy of the layer, and thus the completed object, is improved by, for example, reducing 'washed out' colors and maintaining sharp and crisp borders between different colors in the object.

(Spec. 8, ll. 3-8).

19. Appellants' Specification states that

> The color of a point on a layer of the object is determined by the color at that point and the colors of the points adjacent to that point in the same layer of the object (half toning). The color of the point is also affected by the color of points nearby in layers above and below. The fact that the color at any given point is affected by the color of all surrounding points is specific to the three-dimensional nature of rapid prototyping.

(Spec. 7, ll. 26-32).

20. Shields I discloses that thermal ink-jet printers print "in various colors on bond paper, copier paper, and other media." (Shields I, col. 1, ll. 45-47).

21. Shields II discloses causing the disclosed reaction "on a substrate (e.g. paper)." (Shields II, col. 2, ll. 50-51).

Much of our decision rests on what is meant by the language of claim 1. *Panduit Corp. v. Dennison Mfg. Co.*, 810 F.2d 1561, 1567-1568 (Fed. Cir. 1987)("Analysis begins with a key legal question -- what is the invention claimed? . . . Claim interpretation . . . will normally control the remainder of the decisional process.") (footnote omitted). In our interpretation, the claims, not the specification, measure the protected patent right to exclude others. *Novo Nordisk of North America Inc. v. Genentech Inc.*, 77 F.3d 1364, 1369 (Fed. Cir. 1996); *Phillips v. AWH Corp.*, 415 F.3d 1303, 1314 (Fed. Cir. 2005)("To begin with, the context in which a term is used in the asserted claim can be highly instructive.").

Our reviewing court has repeatedly emphasized that it is not appropriate to read desired embodiments into the claim language. *Phillips*, 415 F.3d at 1323 ("[A]lthough the specification often describes very specific embodiments of the invention, we have repeatedly warned against confining the claims to those embodiments."). Further, the claim language must be given its broadest reasonable meaning. *In re Morris*, 127 F.3d 1048, 1054 (Fed. Cir. 1997)("[A]s an initial matter, the PTO applies to the verbiage of the proposed claims the broadest reasonable meaning of the words in their ordinary usage as they would be understood by one of ordinary skill in the art, taking into account whatever enlightenment by way of definitions or

otherwise that may be afforded by the written description contained in the applicant's specification.").

"Section 103 forbids issuance of a patent when 'the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.'" *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1734 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including (1) the scope and content of the prior art, (2) any differences between the claimed subject matter and the prior art, (3) the level of skill in the art, and (4) where in evidence, so-called secondary considerations. *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966). *See also KSR*, 127 S. Ct. at 1734 ("While the sequence of these questions might be reordered in any particular case, the [*Graham*] factors continue to define the inquiry that controls.").

In considering a reasonable rationale for combining the teachings of prior art references, the problem examined is not the specific problem solved by the invention but a general problem that confronted the inventor before the invention was made. *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006); *see KSR*, 127 S. Ct. at 1742 ("One of the ways in which a patent's subject matter can be proved obvious is by noting that there existed at the time of invention a known problem for which there was an obvious solution encompassed by the patent's claims."). "[I]f a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is

obvious unless its actual application is beyond that person's skill." *KSR*, 127 S. Ct. at 1740.

Applying the preceding legal principles to the Factual Findings in the record of this appeal, we determine that the Examiner has established a prima facie case of obviousness.

Claim 1 recites "causing a reaction that keeps the colorant near a surface of the object." (Claim 1). The phrase "near the surface of the object" is not defined in Appellants' Specification. (*See* Spec.). Rather, the Specification clearly indicates that color is a "surface property," which is provided in each layer of the multi-layer process. (FF 16-19). Shields I and Shields II teach the same reactions involving carboxylated dyes as taught by the present invention. (FF 1-6 and 8-10). To the extent that the reactions taught in Appellants' Specification "keep a colorant near a surface of the object", so do the reactions taught by Shields I and Shields II inherently keep the colorant near a surface of the object.

Since claim 1 is a method claim, the step claimed in this portion of claim 1 merely involves "causing a reaction." Claim 1 is silent as to how the reaction is caused. As instructed by *Phillips*, 415 F.3d at 1323, we decline to require that the reaction occur by the mode suggested in Appellants' Specification, i.e., precipitating a colorant in an ink upon contact with a low pH or cationic powder build material. (FF 9 and 10). Claim 1 also uses the open "comprising" language, meaning that any reasonable additional additive, including another ink or colorant, may be present and still fall within the scope of the claim. Thus, claim 1 is not precluded from the reaction being "caused" by contacting two ink compositions, precisely as described in Shields I and Shields II. (FF 2 and 4).

Thus, addressing our first issue, we determine that the reactions of Shield I and Shield II teach reactions which keep a colorant near a surface of a three-dimensional object, as required by claim 1.

Regarding our second issue, Shields I and Shields II both teach causing this reaction to avoid having the colorant in a first ink bleed or migrate into a second ink. (FF 3 and 6). Shields I also teaches that it was well known in the art to use the same reaction taught in Shields I to achieve waterfastness of an ink upon contact with a treated paper substrate. (FF 7).

Even if one of ordinary skill in the art did not appreciate that the reactions taught by Shields I and Shields II would have kept the colorant near the surface of a three dimensional object, such a skilled artisan would have appreciated the benefits of waterfastness and/or prevention of having colors bleed into one another, as taught by Shields I and Shields II. Therefore, one of ordinary skill in the art would have caused one of the reactions taught by Shields I or Shields II in the process taught by Jang for the advantages to waterfastness and/or color bleeding. It is not necessary that the prior art acknowledge the same benefits or address the same problem as Appellants' invention. *Kahn*, 441 F.3d at 988. Thus, regarding the second issue, we determine that the references provide a reasonable rationale for combining the teachings of Jang and Shields I or Shields II.

Regarding the third issue, Jang teaches that colored droplets are used for forming a three dimensional object "layer-by-layer," or one layer at a time. (FF 12). As such, one of ordinary skill in the art would have understood that a reaction to inhibit migration of inks on a single layer substrate or media (e.g. paper) by an ink-jet printer, as taught by Shields I and Shields II (FF 20 and 21), would have been directly applicable to ink

applied to a single layer of a multi-layer object of a solid freeform fabrication process, as taught by Jang.

Further, Jang teaches that thermal ink-jet printheads may be used for solid freeform processing. (FF 11). Jang also teaches the use of multiple colorants or inks in a liquid composition in solid freeform fabrication for building a multi-color object. (FF 12-14). Jang provides sufficient evidence that one of ordinary skill in the art would have been directed to the art of thermal ink-jet printing regarding problems associated with dyes, inks and other types of colorants used in the solid free form technology taught by Jang. Likewise, the reactions disclosed in Shields I and Shields II are particularly designed for thermal ink-jet printing. (FF 15). Since one of ordinary skill in the art would have recognized that the colorant reactions taught by Shields I and Shields II would have likely improved waterfastness and inhibited bleeding for similar colorants in a solid freeform fabrication system, the combination would have been obvious. *KSR*, 127 S. Ct. at 1740.

Therefore, regarding the third issue, we determine that one of ordinary skill in the art would have reasonably expected the reactions taught by Shields I and Shields II to be successful in a three-dimensional rapid prototype process as taught by Jang.

III. CONCLUSION

Based on the totality of record, including due consideration of the Appellants' arguments, we determine that the preponderance of evidence weighs most heavily in favor of obviousness within the meaning of 35 U.S.C. § 103. Accordingly, we sustain the Examiner's rejection of the claims 1-19.

IV. DECISION

The decision of the Examiner is affirmed.

V. TIME PERIOD FOR RESPONSE

No time period for taking any subsequent action in connection with this appeal maybe extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED

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HEWLETT-PACKARD COMPANY
INTELLECTUAL PROPERTY ADMINSTRATION
P O BOX 272400
FORT COLLINS, CO 80527-2400